(12) PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. AU 200248865 B2
(10) Patent No. 770640

(54) Title
A wedge and spool assembly

(51)6 International Patent Classification(s)
E02F 009/28

(21) Application No: 200248865

(22) Application Date: 2002.06.20

(43) Publication Date : 2002.08.08
(43) Publication Journal Date : 2002.08.08
(44) Accepted Journal Date : 2004.02.26

(62) Divisional of:
200010197

(71) Applicant(s)
Bradken Resources Pty Limited

(72) Inventor(s)
Leslie Herbert Fryer; Fraser Jonathon Batts; Darren Craig Muir

(74) Agent/Attorney
Griffith Hack,GPO Box 4164,SYDNEY NSW 2001

(56) Related Art
AU 75357/96
AU 54935/94

ABSTRACT

A wedging device is suitable for insertion in aligned apertures between components such as an adaptor and a dragline bucket. The wedging device is expandable to wedge together the adaptor and the dragline bucket. The wedging device has a typically C-shaped insert or spool cooperating with a wedge element, the spool and wedge element being interconnected by a tensioning screw which upon rotation in one direction forces the wedge downwardly so that the wedging device achieves its wedging function. The screw is simply removed by unscrewing and an auxiliary screw device is inserted to achieve extraction of the wedge and disconnection.

AUSTRALIA

Patents Act 1990

**COMPLETE SPECIFICATION**

**STANDARD PATENT**

**Applicant(s):**

BRADKEN RESOURCES PTY LIMITED

A.C.N. 098 300 988

**Invention Title:**

A WEDGE AND SPOOL ASSEMBLY

The following statement is a full description of this invention, including the best method of performing it known to me/us:

**A WEDGE AND SPOOL ASSEMBLY**

**FIELD OF THE INVENTION**

The present invention relates to a wedging device for fixing an attachment to a support means. The wedging device may be used to connect an attachment to excavating equipment such as a dragline bucket, rope/hydraulic shovel or other excavating device. Accordingly, embodiments of the invention find application in the landscaping and mining fields.

**BACKGROUND OF THE INVENTION**

Devices for fixing attachments such as teeth or adaptors carrying sacrificial wear parts to dragline buckets are known in the prior art.

Generally, the adaptor is fitted onto a corresponding position of an excavation device lip and a spool inserted into a passageway formed through the adaptor and the lip portion. Conventional practice has been for a wedge to be inserted into the passageway between the spool and a tip region of the nose portion and was then hammered into the passageway with a sledge hammer causing the spool to move rearwardly from the tip of the nose portion and press against the adaptor to thereby force the adaptor tightly onto the nose portion.

However, any misalignment in the openings through the adaptor and nose portion forming the passageway, due to wear or improper fitting of the adaptor, caused difficulty when inserting the wedge. Moreover, chips of metal could fly off the wedge or hammer as the wedge was being forced into the passageway posing a safety problem for persons in the immediate area. In addition, a sledge hammer needed to be available in order to insert the wedge, the use of which also posed a safety problem.

A wedging device comprising a wedge connected to a spool by means of a bolt is disclosed in US patent 4433496.

The wedge has an arcuate surface which bears against a correspondingly contoured arcuate surface on the spool. When the bolt is rotated the wedge is drawn up the arcuate surface of the spool so that a curved contact surface of the wedge is placed into abutment with the nose portion of the dragline bucket. However, the wedge exerts an offset force against the nose portion causing the adaptor to skew as it is drawn onto the nose portion when the bolt is rotated which presents difficulty to the workperson fixing the adaptor in position.

A wedging device consisting of two spools and a separate wedge assembly is disclosed in patent application WO 95/01481. The wedge assembly is comprised of two wedges and a bolt which extends through a passageway formed in one of the wedges and is threadably received in the other wedge. In use, the wedge assembly is positioned between the spools in the passageway formed through the adaptor and the nose portion of the dragline bucket, and the bolt rotated so that the spools are forced apart as the wedges are drawn toward each other causing one of the spools to be pressed against the nose portion and the other spool to be pressed against the adaptor. Accordingly, the movement of the wedges results in the adaptor being drawn onto, and fixed to, the nose portion.

However, the substantial forces which are exerted on the device during an excavating operation can cause a wedge to tilt and so bend the bolt in a region adjacent to the wedge. This may result in difficulty when loosening the bolt to remove the wedging device, and possibly seizure of the device in the dragline bucket. It may also lead to increased downtime of the dragline bucket while the wedging device is removed or at the least, the need for maintenance to the wedging device.

A further wedging device is disclosed in Australian

Patent 676060 based on Application No 68677/94. This device consists of a single spool and a separate wedge assembly comprising two wedges receiving a bolt. As with the device disclosed in WO 95/01481 the bolt extends through a passageway formed in one of the wedges and is threadably received in the other wedge. Accordingly, the arrangement suffers from the same drawback as the device disclosed in WO 95/01481 in that the bolt is prone to bending forces which may result in damage to the wedging device.

Due to the size of dragline buckets as well as the nature of the forces exerted on the buckets during use, the wedging devices are correspondingly large and typically weigh about 6 kg or more.

As the wedging devices disclosed in WO 95/01481 and AU 68677/94 are comprised of a number of separate unconnected parts, difficulties can arise when fixing the devices in position on a dragline bucket due to the need to align the separate parts with each other. The insertion of the wedging devices may also be hampered if there is misalignment of the adaptor and nose portion of the dragline bucket.

The weight of a wedging device of the type disclosed in WO 95/01481 and AU 68677/94 further compounds the difficulty in holding the separate parts of the wedging device together while being lowered into the passageway defined in the nose portion and adaptor. Furthermore, it is common for a workperson to be positioned so as to receive the wedging device from below the passageway as it is lowered into the adaptor and nose portion, and hold the device in position while another workperson tightens the bolt of the wedging device from above the passageway to thereby wedge the separate parts of the device together. The fact that the wedging device exists as separate parts poses safety risks

not only to the workperson receiving the device as it is lowered into the passageway but also to the workperson holding the parts together while lowering the device.

A further development in the art is disclosed in Australian Patent Application No. 48109/96 which discloses a wedging device locatable between two components and consisting of a plurality of parts connected together such that the device remains as a single cohesive assembly during all phases of operation, wherein the parts comprise:

a spool having two inclined surfaces;

a pair of wedges arranged such that the wedges are able to be moved up the inclined surfaces, one to each; and

a rotatable threaded member extending through an aperture formed in the spool and being received by the wedges;

wherein rotation of the threaded member when the device is located between the two components causes the wedges to move toward each other up the respective said inclined surfaces of the spool and be pressed against one of the components to thereby force the spool against the other said component.

In order to cause the wedges to move up the inclined surfaces, the wedging device may be provided with a nut having a female thread engaged with a male thread formed on a shaft of the threaded member, wherein the nut is arranged to be able to exert a pressure on one of the wedges so that the nut and threaded member together force the wedges toward each other when the threaded member is rotated. Alternatively, the male thread of the threaded member may be engaged with a female thread provided on the one wedge itself.

So that the wedges may move up the inclined surfaces the aperture formed in the spool and/or apertures defined in

the wedges which receive the threaded member can have a width which is substantially greater than that of the shaft of the threaded member.

The threaded member is formed such that the engagement of the threaded member with the nut or a female thread formed in one of the wedges holds the wedges on the threaded member. This, together with the reception of the threaded member in the aperture formed in the spool, maintains the wedging device in the form of a single cohesive assembly.

The present invention is directed to embodiments which can provide numerous advantages over previous proposals and in particular aimed to provide safe and convenient fitting and removal in a rugged working environment with a high degree of safety and speed. Downtime of very expensive mining equipment must be minimised and with this requirement in mind embodiments of the present invention facilitates such fitting with just one person.

Broadly, the present invention is found in a wedging device for securing together first and second components having respective apertures which align such that the wedging device can be inserted through the apertures and expanded in a wedging action to secure the components together, the wedging device having

a) an insert member,

b) a wedging member,

c) a tensioning screw for interconnecting the insert member and the wedging member,

d) the insert member and the wedging member having respective abutment surfaces shaped such that relative movement in a first direction between the insert member and the wedging member causes the overall width of the members to expand for wedging engagement in the aligned apertures in the first and second components,

e) the tensioning screw having

i) a screw-threaded shank portion and

ii) an end portion,

f) a body portion associated with one of the insert member and the wedge member and defining a screw-threaded bore for engagement with the shank of the tensioning screw,

g) an abutment portion associated with the other of the insert member and the wedge member for abutment with the tensioning screw to receive axially directed force when the tensioning screw is rotated to cause the relative motion of the insert member and the wedging member in the first direction,

h) access means providing access to an end portion of the tensioning screw when the device is assembled and in use, the access means permitting the tensioning screw to receive applied torque from a tool to rotate the tensioning screw, and the device further comprising

i) a transverse wall on the wedge member which provides the abutment portion and provides a screw threaded bore through which the tensioning screw is a clearance fit and which is adapted to be screw threadably engaged, after removal of the tensioning screw, by a larger diameter extraction screw, rotation of which causes relative movement of the insert member and the wedging member in a direction opposite to the first direction to permit removal of the wedging device;

In a further aspect, the invention extends to a method of mounting one component on another wherein a wedging device in any one of the forms described herein is utilised.

By way of example only, embodiments of the invention will now be described with a reference to the accompanying drawings, of which:

Fig. 1 is a perspective view of an embodiment applied to securing a replaceable digging tool to the front lip of an excavator bucket;

Fig. 2 is a schematic cross-sectional view taken along the line II - II but prior to the wedging device being inserted;

Fig. 3 is an enlarged side elevation of the wedging device showing just the wedging member in cross-sectional view;

Fig. 4 schematically illustrates assembly with the spool member of the wedging device of Fig. 3 initially positioned;

Fig. 5 illustrates the wedging member inserted and engaged with a spool device at the commencement of tightening of the wedging member; and

Fig. 6 illustrates the use of an extraction screw about to be rotated to extract the wedging device from its wedging position;

In various embodiments like numerals have been used for corresponding parts.

Referring first to Figs 1 and 2, an excavator bucket has a leading lip 10 which extends generally horizontally in normal use, the lip terminating in a rounded nose 11 and having a rectangular or rounded aperture 12 at each location where a replaceable digging tooth 13 is to be mounted. Each tooth 13 is mounted on a shoe-like adaptor 14 by means of a conventional wedging pin (not shown). At regular intervals, just the tooth is removed in the field and replaced. The adaptor 14 also requires replacing at intervals and this embodiment of the invention uses a wedging device shown in overall view prior to tightening in Fig. 1 and in more detailed side elevation in Fig. 3.

The wedging device comprises a generally C-shaped spool 15 and a wedge unit 16, the wedging device being adapted to fit into the aperture 12 in the lip and to urge the adaptor 14 rearwardly relative to the lip 10, i.e. in the direction of arrow A shown in Fig. 2.

As most clearly seen in Fig. 2, the adaptor is forked and comprises upper and lower arms 17 and 18 with rearwardly extending cavities 19 and 20 and transverse

walls 21 and 22 in the central region and over which arms 23 and 24 of the C-shaped spool extend. The upper transverse wall 21 has a recess 25 into which a lug 26 of the upper arm of the spool extends in hooking engagement, whereby the spool is retained in position. This is most clearly shown in Fig. 4 during initial assembly. A single operator can readily achieve this assembly and then proceed to insert the wedge unit 16.

Fig. 5 shows the wedging unit 16 positioned into its initial position and a tensioning screw inserted and ready for tightening. As shown in Fig. 1, the wedging unit in plan view is generally U-shaped and is downwardly tapered with a front wedging wall 28 and a pair of spaced rear walls 29 between which a cavity 30 is defined, the walls 29 being adapted to engage in abutment with an inclined front face 31 of the spool 15. Near its upper end, the wedging unit has an interior transverse wall 32 having an enlarged screw threaded bore 33 through which the tightening screw 27 is a clearance fit. A stack of belleville washers 34 support the head 35 of the screw 27 on the transverse wall 32. The operator simply positions the threaded leading end of the screw 27 through the bore 33 and rotates it to screw threadably engage in a threaded bore 36 which extends downwardly through an integral projection 37 of the spool 15, the tensioning screw thereby extending parallel to the inclined leading face 31 of the spool. The screw 37 is tightened in a clockwise direction as indicated in Fig. 5 thereby drawing down the wedging unit 16 and consequentially causing the wedging device to expand in the horizontal direction with a reaction force applied between surfaces 28 of the wedging unit and 12 of the aperture in the lip. This forces a rearwardly directed interior surface 39 of the spool onto confronting respective surfaces of the transverse walls 21 and 22 so that the adaptor moves rearwardly relative to the lip 10 whereby the small clearance shown in Fig. 2 between the nose and the interior of the adaptor is taken

up. Further tightening of the screw 27 causes tensioning of the adaptor whereby its forked arms 17 and 18 are drawn down onto the substantially parallel top and bottom surfaces of the lip. Although not shown in Fig. 2, relative to the lip 10 the forked arms 17 and 18 are slightly divergent to facilitate fitting and to ensure a good clamping effect whereby despite high level of abrasion and shock loads over an extended period of time the adaptor remains firmly fixed to the lip 10 of the bucket.

When the adaptor needs to be removed, a large wrench is simply used to unscrew the tensioning screw 27 and in its place to insert a larger diameter extraction screw 40 shown in Fig. 6. The extraction screw 40 is rotated clockwise and engages in the screw threaded bore 33 and the tip of the extraction screw abuts on the projection 37 around its screw threaded opening but does not engage therein by virtue of its larger diameter. Clockwise rotation of the screw 40 thereby draws the wedging unit 16 upwardly until all tension is removed and then the operator can simply grasp the head of the extraction screw 40 and lift out the wedging device. The spool 15 is then extracted and it is a simple task then to remove the adaptor.

Thus, particularly this preferred embodiment of the invention can provide for a high degree of safety, single operator performance and minimal field down time in order to replace adaptors when worn. Furthermore, a reliable and secure gripping action can be achieved and simple and speedy periodic checking of the tension applied to the tensioning screw 27 is all that is required.

**CLAIMS**

1. A wedging device for securing together first and second components having respective apertures which align such that the wedging device can be inserted through the apertures and expanded in a wedging action to secure the components together, the wedging device having

a) an insert member,

b) a wedging member,

c) a tensioning screw for interconnecting the insert member and the wedging member,

d) the insert member and the wedging member having respective abutment surfaces shaped such that relative movement in a first direction between the insert member and the wedging member causes the overall width of the members to expand for wedging engagement in the aligned apertures in the first and second components,

e) the tensioning screw having

iii) a screw-threaded shank portion and

iv) an end portion,

f) a body portion associated with one of the insert member and the wedge member and defining a screw-threaded bore for engagement with the shank of the tensioning screw,

g) an abutment portion associated with the other of the insert member and the wedge member for abutment with the tensioning screw to receive axially directed force hen the tensioning screw is rotated to cause the relative motion of the insert member and the wedging member in the first direction, and

h) access means providing access to an end portion of the tensioning screw when the device is assembled and in use, the access means permitting the tensioning screw to receive applied torque from a tool to rotate the tensioning screw,

and the device further comprising

i) a transverse wall on the wedge member providing the abutment portion and providing a screw threaded bore through which the tensioning screw is a clearance fit and which is adapted to be screw threadably engaged, after removal of the tensioning screw, by a larger diameter extraction screw, rotation of which causes relative movement of the insert member and the wedging member in a direction opposite to the first direction to permit removal of the wedging device.

2. A wedging device as claimed in claim 1 wherein the abutment portion is provided by a wall integral with the wedging member and provides corresponding one of the abutment portions is in the form of a wall having a lateral opening in which the tensioning screw is removably inserted.

3. A wedging device as claimed in any one of the preceding claims, wherein the tensioning screw has an enlarged head portion at one end adapted to be engageable with the tool to apply torque in either direction to the tensioning screw to tension the screw and remove the screw.

4. A wedging device as claimed in any one of the preceding claims, wherein the body portion is provided on the insert member and the abutment portion is provided on the wedging member, a face of the ???? portion providing an abutment for a free tip of the extraction screw.

5. A wedging device as claimed in claim 3, wherein the tensioning screw has a head portion at an opposite end of the shank to the end portion and a portion of the shank adjacent the end portion is screw-threadbly engaged in a threaded bore in the body portion, the face of the body portion for receiving abutment from the tip of the extraction screw surrounding the threaded bore.

6. A wedging device as claimed in claim 4, wherein the access means is provided in an opening through an upper portion of the wedge member.

7. A wedging device as claimed in any one of the preceding claims, wherein the insert member has (i) a main portion which in use extends through the aligned apertures of the first and second components and (ii) a laterally extending

arm with means for engaging with a portion of one of the components whereby on initial assembly, with the apertures of the first and second components aligned vertically, the insert member is supported by the arm.

8. A wedging device as claimed in claim 6, wherein the means for engaging includes a downwardly extending projection for engaging in a corresponding recess in the second component whereby the insert member is retained in a cantilevered manner.

9. A wedging device as claimed in claim 6 or claim 7 wherein the insert member is generally C-shaped with upper and lower arms extending from the main portion to provide the C-shaped structure, the upper arm of the C-shaped structure providing the laterally extending arm, the main portion providing a wall portion adapted to be substantially vertical in normal installation and having a first side for abutment against respective portions of the second component and an opposite side for sliding engagement with a corresponding inclined wall of the wedging member.

10. A wedging device as claimed in any one of the preceding claims, wherein the wedging member in plan view is generally U-shaped with the arms of the U-shaped terminating in an inclined face adapted for wedging engagement with a confronting surface of the insert member.

11. A wedging device substantially as described herein with reference to the accompanying drawings.

12. A method of removable securing together two components having aligned apertures and including inserting a wedging device as claimed in any one of the preceding claims into the apertures and tightening the tensioning screw to establish a rigid interconnection whereby after renewal of the tensioning screw, the wedging device may be released and renewed by use of the extraction screw.